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Epiphytic microbes and their potentials

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ABSTRACT

Plants harbours various life forms, in that particularly some beneficial microbes over their surface as beneficial epiphytes. Many epiphytes had been discovered for their potential use as plant growth promoting regulators, biocontrol agents and good metabolisers. Prominent epiphytes like some species of Saccharomyces, Ascomycetes, Basidiomycetes are common. Auxin and cytokinin synthesis by yeasts, Vitamin biosynthesis by *Methylobacterium*, killer toxins against phytopathogens produced by Wickerhamomyces were all some of the potentiality of plant epiphytic microbes. Their structure and living depends upon the prevailing environment factors.

Keywords: Biocontrol agents, Epiphytes,Microbiome, Plant growth promoters.

INTRODUCTION

Epiphytic microbes are those organisms that dwell on the surface of plant such as leaf, stem that is over the phyllosphere. These organisms don't harm plants just living in a nonparasitic relationship. They serve multiple functions in plants. Epiphytes involve in the metabolic pathway of plants making some alterations or through some induction. Commonly found epiphytes in plants are several species of yeasts, Ascomycetes, Basidiomycetes and some of Methylotrophs. Some yeasts species are known to induce auxin biosynthesis on external induction of IAA. *Methylobacterium oryzae* belonging to facultative methylotrophs possess certain genes that improves vitaminB_{12} biosynthesis, phosphate solubilisation, decreasing heavy metal toxicity, improving urea metabolism. Epiphytes are also prominent in the aquatic environment. Biofilms found in certain

aquatic plants harbour several useful and potential epiphytes like some nitrifying bacteria such as *Nitrococcus, Nitrosomonas, Nitrospira*. Some other genes include *Proteobacteria, Chloroflexis, Acidobacteria* were also present. Epiphytes as a whole serve as a good mutualistic partner of plants.

GROWTH AND METABOLISM

Growth and metabolism are the basic constituents of any life form. The role of epiphytes here is very crucial. They are present both in terrestrial and aquatic plants. Several species of yeast like *Aureobasidium pullulans, Cryptococcus flavus*, some *Candida* species are known to promote or alter the auxin biosynthesis in plants by exogenous production of IAA. These fungi produce IAA through tryptophan dependent or independent way [1]. *Methylobacterium* species colonising around the stomata, trichomes produce their own auxin, cytokinin, ACC deaminase enzyme and stimulate plant growth.Itpossesses ACC deaminase enzyme through which it reduces the excess ethylene level. Vitamin B_{12} synthesis improves cobalt metabolism [2]. In the aquatic environment eutrophication or algal bloom is a major problem which pollutes the water leaving no sunlight or oxygen to pass through causing death of flora and fauna. Biofilm is good mitigation measure formed by the epiphytes on the aquatic flora containing denitrifying bacteria that denitrifies the nitrates back to air. *Nitrosomonas, Nitrococcus, Nitrospira* are found in free floating *Eichhornia crassipes* and *Trapanatans.* qPCR analysis shows the abundance of denitrifying genes like nitrite and nitrate reductase [3]. The leaf phyllosphere of *A.thaliana*contains prominent microbes like *Actinobacteria, Proteobacteria*, and *Bacteriodetes* have many potentials. The phyllosphere and rhizosphere microbial structure and diversity is influenced by several environmental factors like radiation, temperature, humidity [4]. *Herbaspirillum seropedicae* also promotes growth through biofilm formation on leaves with or without exopolysaccharide formation [5].

DISEASE RESISTANCE

Disease resistance is an important trait essential in plant, that too by means of biological control will be more efficient and ensures biosafety. Fungal and bacterial epiphytes confer protection by producing some metabolites that are antagonistic against pathogens and also through certain mechanisms*. A.pullulans*is a biocontrol agent and has several biotechnological applications. *P.aphidis* secrete some extracellular metabolites that inhibits the fungal pathogens. *Methylobacterium oryzae* genome encodes bacteriocin and a precursor called 4-Hydroxy benzoate that acts as a precursor for activating antifungal proteins in *Nicotiana tabacum*[1]. The blue mould rot, a serious postharvest disease of apple caused by *Penicilliumexpansum* is biologically controlled by *Starmerella bacillaris* that grows on grapes. It is fructophilic, producing more glycerol hence also used in cider formation [6].*Wickerhamomyces anomalus, Torulaspora delbrueckii* effectively controlled the green mould and blue mould caused by *Penicillium*species in lemon by producing low molecular weight killer toxins that has antagonistic activity. *W.anomalus* produces panomycocin that controls anthracnose rot

caused by *Colletotrichum gloeosporoides. Leucosporidium scottii* produces volatile antifungal compounds against *Botrytis cinerea* of apple [7].

CONCLUSION

Microbial epiphytes are ubiquitous everywhere. For control of a disease use of chemical fungicide may be a solution but it can have adverse effect on the quality of the produce causing detrimental disease in both animals and humans. Phyllosphere microbes residing in the above surface of plant have best potential in increasing the metabolism, growth and disease resistance of plants. In the near future it is best that we go for testing the bio efficacy of all these epiphytes and commercially formulate them in such a way they could be used by the farmers to do farming in a chemical free and sustainable way.

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